

Claims 1, 4-14, 17-22, 25-30, 33-35 and 37-84 are pending in this application with claims 1, 14, 21, 30, 37, 53, 61, 63 and 74 being independent.

Claims 1, 14, 21, 30, 63 and 74 have been amended to more clearly recite the features of the invention with respect to recording mainly with a low density ink in certain circumstances and mainly with a high density ink in certain other circumstances. Support may be found in the originally-filed application, for example, in Fig. 6, which is described at pages 19-20 of the specification.

Claims 37, 53 and 61 have been amended to more clearly recite the features of the invention with respect to containing the plurality of inks in a plurality of ink containers. Support may be found in the originally-filed application, for example, at pages 50-54.

Claims 4, 17, 25, 27, 33, 39, 43, 45, 55 and 58 have been amended to improve their form with respect to grammar, antecedent basis or terminology that conforms to that used in other claims. It is submitted that these amendments do not narrow the scope of the affected claims.

Claims 38 and 54 have been cancelled without prejudice or disclaimer in view of the amendment of the

claims from which they depend, namely, Claims 37 and 53, respectively.

It is submitted that no new matter has been added by the amendments herein.

Section 103 Rejection Based on Matsumoto et al.
and Sugimoto et al.

Claims 1, 4-14, 17-22, 25-30 and 33-35 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over Matsumoto, et al. (U.S. Patent No. 4,860,026) in view of Sugimoto, et al. (U.S. Patent No. 5,477,248). Applicants disagree with this rejection as applied to the present claims.

The amendments to Claims 1, 14, 21, 30, 63 and 74 clarify that recording control is performed by using a plurality of inks having different densities in accordance with a level (density level) represented by image data, to obtain a low density image with reduced graininess and a high density image with sharpness. In Applicants' view, the cited references do not teach or suggest the claimed invention.

Matsumoto et al. discloses using a plurality of inks having different densities of the same color series.

Sugimoto et al. addresses the problem of ink blurring at a boundary portion between images having different colors and discloses an order for defining the penetrabilities of each of plural colors of inks in accordance with the brightness of the ink color.

In Applicants' view, combining Matsumoto et al. and Sugimoto et al. would merely provide a system for using a plurality of inks having different densities of the same color series with respect to a plurality of colors of inks, and for differentiating ink penetrabilities with respect to each of the colors.

Applicants submit that although Sugimoto et al. discloses different colors and different penetrabilities, it does not teach or suggest anything about the penetrability of each of a plurality of inks having different densities of the same color series, and disagree with the Examiner's assertion to the contrary. In Example 2, for example, there is one black ink, one cyan ink, one magenta ink and one yellow ink.

The claimed invention defines penetrabilities of each of a plurality of inks having different densities of the same color series. For example, when using ink having a high density (thick ink) and ink having a low density (thin ink),

the penetrability of the thin ink is set to be higher than that of the thick ink. Thus, a region of a low density image recorded mainly by the thin ink can be recorded with reduced graininess, and a region of a high density image recorded mainly by the thick ink can be recorded with good sharpness.

Sugimoto et al. addresses the problem of ink blurring at a boundary portion of images of different colors. Even if Sugimoto et al. and Matsumoto et al. were to be combined, Applicants submit that it is apparent that a low density image with reduced graininess and high density image with good sharpness would not be the result. Accordingly, Applicants conclude that the rejected claims are not taught or suggested by these two references.

Section 103 Rejection Based on Matsumoto et al.,
Sugimoto et al., and Sekiya

Claims 37-84 were rejected over Matsumoto et al. in view of Sugimoto et al. and Sekiya (JP 1-242256). Applicants respectfully disagree with this rejection as applied to the present claims.

Initially, Applicants note that the apparatus and methods recited by claims 63-84 do not recite an ink tank,

the feature for which Sekiya is cited. Accordingly, Applicants submit that the rejection is erroneously applied to Claims 63-84, and that those claims are patentable for the same reasons as independent Claims 1, 14, 21 and 30, as explained above.

Sekiya discloses an ink cartridge provided with a plurality of ink-containing chambers for containing a plurality of inks. In Fig. 1, Sekiya discloses a structure wherein the sizes of the ink-containing chambers are differentiated corresponding to the frequency of use of a plurality of colors of inks. Applicants submit that Sekiya discloses that inks having different colors or having different densities may be contained in the ink cartridge. Applicants submit, however, that Sekiya does not teach or suggest the feature defined by Claims 37, 53 and 61 that a plurality of ink containers correspond to a plurality of colors, each of the ink containers containing a plurality of inks having different dye densities of the same color series. Since the other two cited references do not provide this feature either, Applicants conclude that the combination of Matsumoto et al., Sugimoto et al. and Sekiya does not render the invention of Claims 37, 53 and 61 obvious.

Accordingly, Applicants submit that independent Claims 1, 14, 21, 30, 37, 53, 61, 63 and 74 are not taught or suggested by the cited references, either singly or in the combinations proposed by the Examiner, and respectfully request that the Section 103(a) rejections be withdrawn.

The dependent claims are deemed to be allowable for the reasons given with respect to their respective independent claims and because they recite features which are patentable in their own right. Individual consideration of each dependent claim is respectfully solicited.

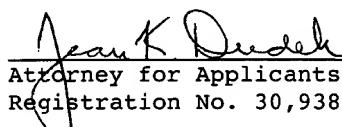
This Amendment After Final Rejection is an earnest attempt to advance prosecution and reduce the number of issues, and is believed to place this application in condition for allowance. No new claims have been added. Furthermore, Applicants respectfully submit that a full appreciation of these amendments will not require undue time or effort given the Examiner's familiarity with this application. Accordingly, entry of this Amendment under 37 C.F.R. § 1.116 is respectfully requested.

Applicants submit that the instant application is in condition for allowance. Favorable reconsideration,

withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Twice Amended) ink-jet recording apparatus for forming an image on a recording medium comprising a plurality of ink discharge means and a plurality of ink discharge openings and containing a plurality of inks, wherein the plurality of inks is discharged from the plurality of ink discharge openings by driving the ink discharge means, each ink having a penetrability, a dye density and a color;

 said plural ink discharge openings corresponding to a plurality of inks with different dye densities, wherein the penetrabilities of inks having different dye densities and same colors are different from each other and ink having low dye density among the plurality of inks of different dye densities and same colors has more penetrability with respect to the recording medium than ink having high dye density;

 and wherein said plurality of inks contain different component ratios of a surfactant, wherein an ink having a relatively high dye density has a lower component ratio of said surfactant than an ink having a relatively low dye density,

said apparatus further comprising control means for performing gradational recording by controlling discharge of each of the plurality of inks with different dye densities based on inputted image data, the image data being data representing a density level.

wherein said control means controls recording so that recording is performed by mainly using ink having low dye density when the density level represented by the image data is relatively low and recording is performed by mainly using ink having high dye density when the density level represented by the image data is relatively high.

4. (Amended) The ink-jet recording apparatus according to claim 1, wherein said plural inks consist [consists] of the first ink with a relatively high dye density in ink and the second ink with a relatively low dye density in ink in comparison with the first ink, said first ink containing no surfactant in a composition thereof, while said second ink contains [containing] said surfactant in a composition thereof.

14. (Twice Amended) An ink-jet recording method for forming an image on a recording medium comprising the steps of:

providing a plurality of inks, each having a penetrability, a dye density and a color;

providing a recording medium;

providing a plurality of ink discharge openings and a plurality of ink discharge means;

discharging onto the recording medium the plurality of inks from the plurality of ink discharge openings by driving the ink discharge means;

said plurality of ink discharge openings corresponding to a plurality of inks with different dye densities, wherein the penetrabilities of inks having different dye densities and same colors are different from each other, and ink having low dye density among the plurality of inks of different dye densities and same colors has more penetrability with respect to the recording medium than ink having high dye density;

wherein said plurality of inks contain different component ratios of a surfactant, wherein an ink having a relatively high dye density has a lower component ratio of

said surfactant than an ink having a relatively low dye density;

performing gradational recording by controlling discharge of each of the plurality of inks with different dye densities based on inputted image data, the image data being data representing a density level,

wherein discharge is controlled so that recording is performed by mainly using ink having low dye density when the density level represented by the image data is relatively low and recording is performed by mainly using ink having high dye density when the density level represented by the image data is relatively high.

17. (Amended) The ink-jet recording method according to claim 14, wherein said plural inks consist [consists] of the first ink with a relatively high dye density in ink and the second ink with a relatively low dye density in ink in comparison with the first ink, said first ink containing no surfactant in a composition thereof, while said second ink contains [containing] said surfactant in a composition thereof.

21. (Twice Amended) An ink-jet recording apparatus, comprising a recording head equipped with a plurality of ink discharge means, and a plurality of discharge ports and containing a plurality of inks, wherein the plural discharge ports of said recording head are comprised of a plurality of discharge port trains corresponding to the plurality of inks, wherein the plurality of inks is discharged onto a recording medium to form an image, each of the plurality of inks having a penetrability, a color and a different dye density, wherein the penetrabilities of inks having different dye densities and same colors are different from each other and ink having low dye density among the plurality of inks of different dye densities and same colors has more penetrability with respect to the recording medium than ink having high dye density;

and wherein said plurality of inks contain different component ratios of a surfactant, wherein an ink having a relatively high dye density has a lower component ratio of said surfactant than an ink having a relatively low dye density,

said apparatus further comprising control means for performing gradational recording by controlling discharge of each of the plurality of inks with different dye densities

based on inputted image data, the image data being data representing a density level.

wherein said control means controls recording so that recording is performed by mainly using ink having low dye density when the density level represented by the image data is relatively low and recording is performed by mainly using ink having high dye density when the density level represented by the image data is relatively high.

25. (Amended) The ink-jet recording apparatus according to claim 21, wherein said plural inks with different dye densities in ink consist [consists] of the first ink with a relatively high dye density in ink and the second ink with a relatively low dye density in ink in comparison with the first ink, said first ink containing no surfactant in a composition thereof, while said second ink contains [containing] said surfactant in a composition thereof.

27. (Amended) The ink-jet recording apparatus according to claim 26, further comprising a distribution means which divides [divide] entered data as recording data

for said plural inks with different dye densities in inks in accordance with a gradation indicated by an inputted image signal.

30. (Amended) An ink-jet recording apparatus, comprising a plurality of recording heads equipped with a plurality of ink discharge means and a plurality of discharge ports and containing a plurality of inks, wherein said plural recording heads correspond to the plurality of inks, each ink having a penetrability, a color and a different dye density, wherein the plurality of inks is discharged onto a recording medium to form an image, and wherein the penetrabilities of inks having different dye densities and same colors are different from each other and ink having low dye density among the plurality of inks of different dye densities and same colors has more penetrability with respect to the recording medium than ink having high dye density;

and wherein said plurality of inks contain different component ratios of a surfactant, wherein an ink having a relatively high dye density has a lower component ratio of said surfactant than an ink having a relatively low dye density,

said apparatus further comprising control means for performing gradational recording by controlling discharge of each of the plurality of inks with different dye densities based on inputted image data, the image data being data representing a density level.

wherein said control means controls recording so that recording is performed by mainly using ink having low dye density when the density level represented by the image data is relatively low and recording is performed by mainly using ink having high dye density when the density level represented by the image data is relatively high.

33. (Amended) The ink-jet recording apparatus according to claim 30, wherein said plural inks with different dye densities in ink consist [consists] of the first ink with a relatively high dye density in ink and the second ink with a relatively low dye density in ink in comparison with the first ink, said first ink containing no surfactant in a composition thereof, while said second ink contains [containing] said surfactant in a composition thereof.

37. (Amended) An ink-jet recording apparatus which forms an image on a recording medium by using a plurality of ink discharge means discharging a plurality of inks, wherein said plural ink discharge means correspond to the plurality of inks, [which have different dye densities, and said plural inks having different dye densities are divided and held in the same ink container] the plurality of inks are inks having different dye densities with respect to a plurality of colors, the plurality of inks are contained in a plurality of ink containers and each of the plurality of ink containers corresponds to a different color of ink, each of the ink containers containing a plurality of inks having different dye densities of a same color series.

38. Cancelled.

39. (Amended) The ink-jet recording apparatus according to claim 37, wherein said plural inks having different dye densities in ink are held in said ink containers [container], the volume of each of said inks being different.

43. (Amended) The ink-jet recording apparatus according to claim 41, wherein said plural inks with different dye densities in ink consists of the first ink with a relatively high dye density in ink and the second ink with a relatively low dye density in ink in comparison with the first ink, said first ink containing no [surface active component] surfactant in a composition thereof, while said second ink containing said surfactant [surface active component] in a composition thereof.

45. (Amended) The ink-jet recording apparatus according to claim 44, further comprising a distribution means which divides [divide] entered data as recording data for said plural inks with different dye densities in inks in accordance with a gradation indicated by an inputted image signal.

53. (Amended) An ink-jet recording apparatus, containing a plurality of inks and comprising a plurality of recording heads equipped with a plurality of ink discharge means, which discharge ink through discharge ports, and forming an image on a recording medium by discharging the ink

through a plurality of discharge ports of said recording heads, wherein said plural recording heads correspond to the plurality of inks, [which have different dye densities, and said plural inks of different dye densities are divided and held in the same ink container] the plurality of inks are inks having different dye densities with respect to a plurality of colors, the plurality of inks are contained in a plurality of ink containers and each of the plurality of ink containers corresponds to a different color of ink, each of the ink containers containing a plurality of inks having different dye densities of a same color series.

54. Cancelled.

55. (Amended) The ink-jet recording apparatus according to claim 53, wherein said plural inks having different dye densities in ink are held in said ink containers [container], the volume of each of said inks being different.

58. (Amended) The ink-jet recording apparatus according to claim 57, further comprising a distribution

means which divides [divide] entered data as recording data for said plural inks with different dye densities in inks in accordance with a gradation indicated by an inputted image signal.

61. (Amended) An ink-jet recording apparatus containing a plurality of inks and comprising a plurality of recording heads equipped with a plurality of ink discharge means for discharging inks and forming an image on a recording medium by discharging the inks from a plurality of discharge ports of said recording heads, wherein said plural recording heads correspond to the plurality of inks having different color materials, the plural discharge ports of said recording heads comprising a plurality of discharge port trains corresponding to the plural inks having different dye densities, [and said plural inks having different dye densities are divided and held in the same ink container] the plurality of inks are inks having different dye densities with respect to a plurality of colors, the plurality of inks are contained in a plurality of ink containers and each of the plurality of ink containers corresponds to a different color of ink, each of the ink containers containing a

plurality of inks having different dye densities of a same color series.

63. (Amended) An ink-jet recording apparatus for recording by discharging a plurality of inks having different densities of a same color series for use with an ink-jet head for discharging ink, comprising:

 a recording control means for recording by discharging a plurality of inks having different densities of a same color series by said ink-jet head, wherein the recording control means controls discharge of each of said plurality of inks in accordance with a level represented by input image data,

 wherein each of said plurality of inks having different densities of the same series of color contains a different amount of surfactant for enhancing penetrability with respect to a recording medium, such that an ink having a low density contains a greater amount of said surfactant than an ink having a high density, and

wherein said recording control means controls recording with a plurality of inks having different densities so that recording is performed by mainly using ink having low

density when the image data is a low level and recording is performed by mainly using ink having high density when the image data is a high level.

74. (Amended) An ink-jet recording method for recording by discharging a plurality of inks having different densities of a same color series for use with an ink-jet head for discharging ink, comprising the steps of:

inputting image data representing a density level;
generating data for discharging ink, corresponding to each of a plurality of inks having different densities of a same color series in accordance with said image data; and
recording by discharging ink based on said generated data,

wherein each of said plurality of inks having different densities of the same color series contains a different amount of surfactant for enhancing penetrability with respect to a recording medium, such that an ink having a low density contains a greater amount of said surfactant than an ink having a high density, and

wherein recording is performed with a plurality of inks and by mainly using ink having low density when the

image data is a low level and mainly using ink having high density when the image data is a high level.